Can a Commercially Available Auditory Training Program Improve Audiovisual Speech Performance?
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Introduction

ReadMyQuips™ (RMQ™), a commercially available, computer-based training program is designed to improve speech perception in everyday noisy listening environments. It employs an audiovisual (AV) approach to auditory training for adults with hearing loss. Training with AV material has been shown to improve speech-in-noise performance and enhance perceptual learning, demonstrating superior effects for AV training relative to auditory only (AO) training (Bernstein et al., 2013; Moradi et al., 2013; Kawase et al., 2009; Zilber et al., 2014). We sought to use an AV, in addition to an AO, outcome measure to investigate the efficacy of RMQ™ in improving speech perception in noise. To date, several studies have investigated the efficacy of auditory training using AO outcome measures alone (e.g., Olson et al., 2013), and showed behavioral improvements following training. In particular, engagement in RMQ™ training resulted in individual speech-in-noise improvements (Abrams et al., 2015). Using an AV outcome measure is a novel approach, and might capture the potential improvements resulting from this program that targets AV speech perception.

Purpose

Specifically, this study aimed to determine if hearing aids, in combination with computer-based auditory training, improved AV speech performance compared to the use of hearing aids alone.

We predicted that new hearing aid users trained with an AV training paradigm (i.e. RMQ™) would show improvement in both unisensory (AO) and multisensory (AV) speech perception performance when compared to listeners wearing hearing aids alone.

Materials and Methods

Participants

• 24 first time hearing aid users.
• Audiometric thresholds in the normal to moderate range for frequencies > 1500 Hz and in the mild to profound range for frequencies ≥ 2000 Hz.
• Participants were randomly assigned to two groups: (1) Experimental: Eight males and six females (mean age = 68 years, SD = 8.4, range = 51-84 years) received hearing aids and RMQ™ training (2) Control: Ten males and two females (mean age = 69.9 years, SD = 10.5 years, range = 62–81 years) received hearing aids without training.

Hearing Aid Fitting

• Binuaral 3 Series 110 receiver-in-the-canal (RIC) 13 Starkey hearing aids (Eden Prairie, Minnesota, USA)
• NAL-NL2 prescription targets verified with real-ear measures
• C5 Nufit fitting feature verified that participants used hearing aids for at least 6 hours each day.

Auditory Training Program: ReadMyQuips™

Completed participants in the Experimental Group while wearing hearing aids:
• 30 minutes per day, 5 days per week, 4 weeks
• Modified crossword puzzle consisting of witty quips
• Adaptively adjusts the SNR based on performance of listener.

Outcome Measure: Multisyllabic Lexical Sentence Test for Adults™ (MLST-A™) (Kirk et al., 2012)
• Audio-only, visual-only, and audio-visual presentations.
• Five male & five female speakers.
• 12 equivalent lists with 24 sentences and three key words per sentence.
• Controlled for lexical characteristics of frequency and neighborhood density (Bell & Wilson 2001).
• Sentence presentation level: 60 dB SPL.
• SNRs: -5 dB, 0 dB, and -5 dB.
• Conditions: auditory only (AO) and audiovisual (AV).
• Speech and noise were presented through a speaker at 0° azimuth.
• Video recordings were presented on a computer monitor placed one meter away from the participant.

MLST-A™ was administered to participants as follows:
(1) on the day of hearing aid fitting (prettest).
(2) after 4 weeks of hearing aid use prior to RMQ™ training (posttest I).
(3) following 4 weeks of RMQ™ training or no treatment (posttest II).

Schematic of Study Timeline

Results

A between-groups ANOVA was conducted with test, mode and SNR as factors.
• No significant difference in AO speech and performance between the experimental and control groups (Figure 1), indicating no effect of training, F(2, 44) = 2.3, p = .12.
• AV scores were always greater than AO scores F(1, 22) = 20.5, p < .01.
• Performance at more favorable SNRs was better than at less favorable SNRs for both AV and AO conditions F(2, 44) = 52.0, p < .001.

Results

Discussion and Conclusions

• The findings of this study did not reveal any improvements in AO or AV speech performance on the MLST-A™ post-auditory training. Therefore, the advantages of RMQ™ training for AV perception learning cannot be inferred from this current study.
• It is possible that the MLST-A™ was not sensitive to potential AV training gains that listeners may have obtained during RMQ™ training, such as improvements in cognitive processes underlying AV speech perception. It is believed that top-down processes mediate AV learning (Schroeder et al. 2008) and research on auditory training programs has demonstrated broader applicability in benefiting cognitive processes by showing generalized improvements in non-trained tasks, such as working memory and speed of processing (Ferguson & Henshaw 2015).
• In light of the wide range of cognitive processes involved in AV speech perception, future research may include a variety of cognitive and listening effort measures, in addition to documenting self-report of everyday communication as means to tap into perceived AV benefits in real-world listening environments.
• Another explanation as to why RMQ™ training did not result in improved AV performance may be because the period of training (4-6 weeks) was relatively short. We may have observed training effects with longer AV exposure (Lestad et al. 2014).
• Variation in baseline speechreading abilities across participants may have influenced their post-training AV speech performance (Eberhardt, Auer, & Bernstein 2014). Future studies may consider measuring baseline speechreading skills using tests such as the Uley Lipreading Test (Uley, 1946), Auditory Discrimination and Lip Reading Skills Inventory, and Craig Lipreading Inventory.

References